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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte IWAO SAKAI,
SATOSHI KUSHIDA, NORIYOSHI MACHIDA, and
MITSURU IKEDA

Appeal 2009-002285
Application 10/529,400
Technology Center 2800

Decided: August 25, 2009

Before CHUNG K. PAK, PETER F. KRATZ, and MARK NAGUMO, *Administrative Patent Judges.*

NAGUMO, *Administrative Patent Judge.*

DECISION ON APPEAL

A. Introduction[1, 2]

Iwao Sakai, Satoshi Kushida, Noriyoshi Machida, and Mitsuru Ikeda ("Sakai") timely appeal under 35 U.S.C. § 134(a) from the final rejection[3] of claims 1-12 and 17-22, which are all of the pending claims.[4] We have jurisdiction under 35 U.S.C. § 6. We REVERSE.

The subject matter on appeal relates to a device for measuring the flow rate of a fluid moving in a tube by measuring the transmission of a shock wave through the fluid and calculating the flow rate of the fluid from the measured characteristics.

Representative Claim 1 is reproduced from the Claims Appendix to the Principal Brief on Appeal:

> 1. A method for measuring a flow rate of a fluid moving in a tube which comprises the steps of:
>
> (1) preparing a flowmeter comprising a set of a first upstream side shock wave-generating piezoelectric element and a first downstream side shock wave-receiving piezoelectric element

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[1] Application 10/529,400, *Method and Apparatus for Measuring Flow Rate of Fluid*, filed 28 March 2005, as the national stage under 35 U.S.C. § 371 of PCT/JP04/07525, filed 1 June 2004. The specification is referred to as the "400 Specification," and is cited as "Spec." The real party in interest is listed as Avance Techne Accent Corp. (Appeal Brief, filed 13 November 2007 ("Br."), 2.)

[2] Sakai waived the hearing scheduled for 17 September 2009.

[3] Office action mailed 16 February 2007 ("Final Rejection"; cited as "FR").

[4] In the Final Rejection, the Examiner rejected claims 1-26. In an amendment filed 16 May 2007, after the final rejection, claims 13-16 and 23-26 were canceled by Sakai. The Examiner entered this amendment on 25 May 2007.

and a set of a second downstream side shock wave-generating piezoelectric element and a second upstream side shock wave-receiving piezoelectric element arranged on a surface of the tube under such condition that the shock wave-generating piezoelectric element and the shock wave-receiving piezoelectric element of each set are arranged along a fluid-moving direction apart from each other at an equivalent distance;

(2) causing movement of the fluid in the tube and, while the fluid is moving, an *impulse voltage* with steep rising edge or steep falling edge is applied to the first shock wave-generating piezoelectric element *to generate a shock* and transmit the shock through a wall of the tube into the moving fluid so as *to produce a shock wave in the moving fluid*;

(3) *transmitting the shock wave through the moving fluid and receiving the transmitted shock wave* by the first shock wave-receiving piezoelectric element through the wall of the tube;

(4) while the fluid is moving, an *impulse voltage* with steep rising edge or steep falling edge is applied to the second shock wave-generating piezoelectric element *to generate a shock* and transmit the shock through the wall of the tube into the moving fluid so as *to produce a shock wave in the moving fluid*;

(5) *transmitting the shock wave* generated in the step (4) through the moving fluid and *receiving the transmitted shock wave* by the second shock wave-receiving piezoelectric element through the wall of the tube;

(6) processing data of the wave received in the step (3) and data of the wave received in the step (5) to obtain data of a composite wave and detecting a predetermined characteristic value from the data of the composite wave;

(7) preparing a relationship between a moving rate of the fluid and the same characteristic value of data of a composite wave corresponding to the moving rate separately; and

> (8) comparing the characteristic value of data of the composite wave obtained in the step (6) with the relationship obtained in the step (7), to calculate the flow rate of the fluid of the step (2).

(Claims App., Br. 11-12; indentation and emphasis added.)

The Examiner has maintained the following ground of rejection:[5]

> A. Claims 1-12 and 17-22 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of admitted prior art and Ohnishi.[6]

Sakai argues that the Examiner erred in holding the claimed invention obvious because Ohnishi does not teach or suggest the limitation of producing a shock wave in the moving fluid and determining the rate of flow of the fluid based on the "time required for transmitting the generated shock wave through the moving fluid." (Br. 8, emphasis omitted.) In particular, Sakai denies that the 400 Specification contains an admission that an "oscillation wave" is a "shock wave." (*Id.*) Sakai argues further that the Examiner has misunderstood Ohnishi, and that Ohnishi teaches that the applied ultrasound propagates in the wall of the pipe, not in the liquid moving inside the pipe. (Br. 9-10.)

The Examiner maintains that Sakai "has admitted that the oscillation wave is regarded as a shock wave," citing the 400 Specification at page 4, lines 23-24). (Ans. 4.) The Examiner argues further that the waveforms shown in Ohnishi Figures 4, 6, 8, and 12 have steep rises and falls, and are

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[5] Examiner's Answer mailed 28 January 2008. ("Ans.").

[6] Kazumasa Ohnishi, *Method for Measuring Flow of Fluid Moving in Pipe or Groove-like Flow Passage*, U.S. Patent Application Publication US 2004/0050176 A1 (18 March 2004).

therefore shock waves, "since oscillation wave of Ohnishi performs the same function as the shock wave of the instant specification; the oscillation wave is a shock wave." (*Id.* at 5.)

B. Findings of Fact

Findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

1. The 400 Specification states that the inventors have studied ultrasonic waves generated by piezoelectric ultrasonic transducers in conventional flow meters and that they have:

> discovered that if the sine wave alternating energy employed in the conventional system for applying the energy to the piezeoelectric element is replaced with a shock energy caused by application of an impulse voltage having steep rising edge or steep falling edge, an oscillation wave (i.e., shock wave) received by a wave-receiving piezoelectric element after generation and transmission in a flowing fluid gives a simpler wave form and hence the determination of the target point for the measurement of transmission period is facilitated. This phenomenon has not been known until now.

(Spec. 4, ll. 18-29.)

2. We take official notice that the term "shock wave" is a well-defined term of art in fluid mechanics.

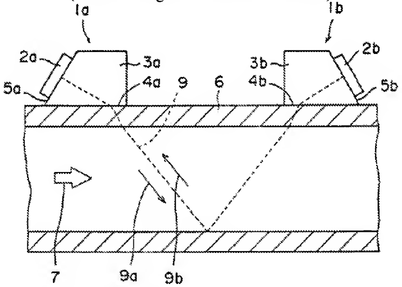
3. Sakai quotes a definition of the term "shock wave" from the *McGraw-Hill Dictionary of Scientific and Technical Terms*, 3d ed. as being "a fully developed compression wave of large amplitude, across which density, pressure, and particle velocity changes dramatically." (Br. 8.)

4. Sakai states that this definition was submitted during prosecution in an amendment filed 25 January 2007. (Br. 8.)

5. The Examiner acknowledges the arguments filed on 25 January 2007, generally, and does not contest that the definition was submitted; nor does the Examiner contest the proffered definition of a shock wave. (Ans. 4-5.)

6. Ohnishi describes a conventional method and device for measuring the flow rate of a liquid moving in a conduit, with reference to Figure 1, which is reproduced below:

{Ohnishi Figure 1 is shown below}

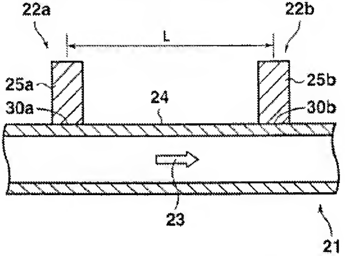


{Figure 1 is said to show a conventional flow measuring device}

7. According to Ohnishi, ultrasonic waves are generated by application of a voltage pulse to transducer 2a, and they propagate along path 9 through the various elements of the device, including in the moving fluid 7 in the tube 6. (Ohnishi 1, ¶ [0006].)

8. Ohnishi describes an inventive device shown in Figure 2, which is reproduced below:

{Ohnishi Figure 2 is shown below}



{Ohnishi figure 2 is said to show a fluid flow measuring device}

9. According to Ohnishi, the known oscillation wave generating-detecting means used in the conventional ultrasonic flowmeter shown in Figure 1 can be used in the inventive flowmeter shown in Figure 2. (Ohnishi 8, ¶ [0140].)

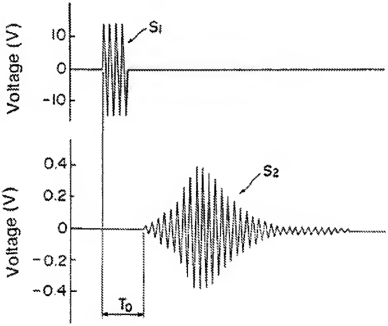
10. The inventive flow meter comprises a tube 21 fitted on wall 24 with oscillation-wave generating-detecting means 22a and 22b. (Ohnishi 9, ¶ [0140].)

11. Ohnishi teaches that the oscillation wave "is not limited to the generally called ultrasonic wave having a frequency of not less than 20 kHz." (Ohnishi 8, ¶ [0143].)

12. Ohnishi teaches further that "[a]n oscillation wave having a frequency of 10 kHz to 1 MHz is favorably applied to the wall." (Ohnishi 8, ¶ [0143].)

13. According to Ohnishi, the voltage waveform S1 shown in Figure 4 (the "fourth period of a sine wave voltage (frequency: 52 kHz, amplitude (peak-to-peak value): 30 V)" was applied to the first oscillation wave generating-detecting means 22a. (Ohnishi 9 ¶ [0157].)

14. Ohnishi Figure 4 is shown below:



{Ohnishi Figure 4 is said to show applied and detected waveforms}

15. Ohnishi states that voltage waveform S2, shown in Figure 4, is the oscillation wave transmitted in the wall 24 of the tube 21 and detected by the second oscillation wave generating-detecting means [22b]. (Ohnishi 9, ¶ [0156].)

16. According to Ohnishi, timing data and the speeds of propagation of sound in the acrylic resin of the wall 24 and in water (the contents of tube 21), respectively, show that the oscillation wave is transmitted in the wall of the tube. (Ohnishi 9 ¶¶ [0158]-[0159].)

C. Discussion

As the Appellant, Sakai bears the procedural burden of showing harmful error in the Examiner's rejections. *See, e.g., In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("On appeal to the Board, an applicant can overcome a rejection [under § 103] by showing insufficient evidence of *prima facie* obviousness") (citation and internal quote omitted).

The passage of the 400 Specification in which the Examiner finds an "admission" of the equivalence of the terms "oscillation wave" and "shock wave" states that the inventors found that if the sine wave used by the prior art to excite waves in the prior art piezoelectric transducer is replaced by a shock energy produced by applying a sharp-edged impulse voltage (i.e., having a sharp rising or falling edge), the shock wave detected by the receiving element has a simpler wave form. The simpler wave form permits an easier determination of the "target point," and the flow rate of the fluid can be determined more accurately.

We agree with Sakai that the 400 Specification provides no credible basis for any general admission that Sakai has used the general term "oscillation wave" as an equivalent for the term of art "shock wave." More importantly, we find no credible basis for the Examiner's apparent conclusion that the term "oscillation wave," as used by Ohnishi, refers to a "shock wave." The Examiner has neither explained why, nor pointed to any credible evidence indicating that the applied wave form S1 would plausibly generate a shock wave, or that detected wave form S2 (or any other disclosure in Ohnishi or in the record) indicates that a shock wave was detected.

We further agree with Sakai that the record shows the Examiner misapprehended the teachings of Ohnishi regarding in what medium the "oscillation waves" propagate. Ohnishi teaches that the oscillation waves propagate in the wall of the pipe, not in the fluid contained in the pipe. (Ohnishi 9, ¶¶ [0158]-[0159].)

We conclude that Sakai has demonstrated harmful error in the Examiner's findings of fact that underpin the rejection for obviousness, and we therefore REVERSE the rejection of record.

D. Order

We REVERSE the rejection of claims 1-12 and 17-22 under 35 U.S.C. § 103(a) in view of the combined teachings of admitted prior art and Ohnishi.

REVERSED

PL Initial:
sld

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